just as are the shore reefs of the neighbouring atoll of Diego Garcia ; but the lagoon contains many knolls abundantly covered with living coral, and there is reason to think that living coral also occurs on the external slopes at Diego Garcia. Unlike Capt. Wharton, I do not consider the favourable conditions for coral growth on the external slopes to be connected with a better food supply, for this would be at variance with the existence of thriving coral patches within the lagoon, which, as I have seen at Diego Garcia, bear no relation to the lagoon mouths, through which food-bearing currents might be supposed to enter to the interior. Indeed, at the last-named atoll some of the most luxuriant coral patches are found at the south end of the lagoon, furthest away from the lagoon outlet. The favourable conditions are due, I believe, to the action of currents on coral growth. I noticed at Diego Garcia, and Dr. Hickson has made similar observations in the reefs near North Celebes, that corals do not thrive where they are subjected to the direct action of a strong current, nor do they grow in still water, where they are killed by the sand deposited upon them, but they flourish in places where a moderate current flows over them, not so strong as to dash them to pieces, but strong enough to prevent deposition of sand. Such conditions are found everywhere on the external slopes. At the side where a current impinges directly on a slope, the deeper parts of the current strike the slope first, and are in part thrown upwards over the sloping surface, thus moderating the direct force of the more superficial part of the same current. The main part of the current flows tangentially around the obstruction, and thus affords favourable conditions at the sides of the atoll or reef, and finally, on the side furthest from the current, the back-wash causes weak superficial currents which are also highly favourable to coral growth. Thus the coral grows to the greatest advantage around the periphery of a reef, and, as Capt. Wharton says, a ring-shaped reef is the result, and no theory of solution is required to explain the central depression.

Capt. Wharton states that live coral exists in abundance on the rim of the Tizard Reef. It is not clear whether this means on the external slopes and on the extreme edge of the reef, or on the flat upper surfaces of the reef itself. From what I have observed at Diego Garcia, it appears to me hardly probable that the latter can be the case. Coral debris, torn from the corals growing on the slopes, is always carried across those flat surfaces in such quantity as to destroy any living corals upon them. In some cases corals may grow there, but then there are other favourable conditions neutralizing the effect of the debris. I am hoping soon to publish a full account of my observations at Diego Garcia. G. C. BOURNE.

Anatomical Department, Oxford, February 28.

Natural Science and the Woolwich Examinations.

In accordance with Mr. Irving's recommendation, I have carefully considered the letter in the *Times* from the head master of Clifton College ; but, with all due respect to his distinguished position, I find myself unable to accept his conclusions. Men of science will pardon me, if I ask them to examine facts, rather than to follow blindly even the highest authority.

The obligatory mathematics to be required from candidates for Woolwich are defined as follows in the official regulations, dated December 1887 :—

"Algebra up to and including the binominal theorem ; the theory and use of logarithms ; Euclid, Books i. to iv. and vi. ; plane trigonometry up to and including the solution triangles ; mensuration ; statics—the equilibrium of forces acting in one plane and of parallel forces, the centre of gravity, the mechanical powers ; dynamics—uniform, uniformly accelerated, and uniform circular motion, falling bodies and projectiles *in vacuo*. (Analytical methods of solution will not be required.)

"N.B.—A thorough knowledge of each of the above branches of mathematics will be required."

This amount of mathematics is not beyond the reach of a fairly intelligent lad of seventeen who has been properly taught.

The inductive process which leads Mr. Irving to denounce so severely my supposed inappreciation of the value of experimental demonstration, laboratory training, and field work is hardly worthy of so eminent a teacher. Although there are good grounds for my opinion that chemistry, physics, and geology, are not good educational subjects for ordinary lads under sixteen, I am entirely consistent in the expression of my regret that the War Office should have thought it desirable to discourage these sciences. Your able article conclusively proves that these subjects cannot be hastily and superficially learned in such a way as to gain unmerited marks. There are youths with apt intelligences, quick eyes, and skilful fingers, who ought to be allowed the advantage of their scientific capacity in the Woolwich competition. But I am unable to see that Mr. Irving's suggestion would do justice to these. A candidate who offered optional mathematics, one language, and two sciences, would be placed at a great disadvantage with those offering optional mathematics, and three languages, both on account of the lower maximum, and also because, with the same relative proficiency, it is so much harder to score in mathematics and experimental sciences and geology than in languages. I therefore respectfully submit that all who have the interests of science at heart should urge that the maximum should be raised to 3000 marks, but I do not think it would be desirable to allow candidates to take more than one subject from Class II., as it would tend to the neglect of more important studies.

2 Powis Square. HENRY PALIN GURNEY.

International Tables.

I AM instructed by the Meteorological Council to request your insertion of the following notice :—

The International Meteorological Congress, which met at Rome in 1879, recommended that a series of international tables should be prepared and issued.

The work was ultimately intrusted to a Sub-Committee, consisting of Prof. Wild and Prof. Mascart.

The Sub-Committee has prepared a scheme of tables, which has met with a general acceptance among the heads of European meteorological organizations.

The tables will be in royal quarto, and will cover about 400 pages. The price of the work, to be published by Gauthier-Villars, will be 35 francs.

The Council are requested by the gentlemen who have prepared the tables to ascertain the probable demand for the work in this country, and I am therefore to request through your columns that any intending purchaser will send his name to me.

ROBERT H. SCOTT.

Meteorological Office, 116 Victoria Street, London, S.W.,
February 16.

PLAN OF TABLES.

CHAPTER I.

Section I. Length.

1.	French lines	to mm.	...	0—100 lines
2.	,,	,, English inches	...	,,
3.	French inches and lines	,, mm.	...	20—30 inches
4.	French lines	,, English inches	...	250—350 lines
5.	English inches	,, mm.	...	0—100 inches
6.	,,	,, ,,	...	17—32 ,, (in ·001 inch)
7.	mm.	,, English inches	...	0—100 mm.
8.	,,	,, ,,	...	440—800 ,,
9.	Russian half-lines	,, mm.		
10.	,, ,,	,, English inches		
11.	French feet	,, metres		
12.	,,	,, English feet		
13.	English feet	,, metres		
14.	Metres	,, English feet		
15.	Kilometres	,, English miles		
16.	English miles	,, kilometres		

Section II. Weight.

1.	Grains	to grammes
2.	Grammes	,, grains

Section III. Time and Angular Measure.

1.	Days of year	to decimals of year and to angles
2.	Hours	,, ,, ,,
3.	Minutes	,, ,, ,,
4.	Hours	,, decimals of day
5.	Minutes	,, ,, ,,
6.	Seconds	,, ,, ,,
7.	Minutes or seconds	,, decimal of the hour or minute
8.	Seconds	,, decimals of hour
9.	Longitude	,, time
10.	Time	,, longitude

CHAPTER II.—GEODETICAL.

1. Variation of gravity with latitude and altitude.
2. Degrees on the meridian.
3. ,, on circles of latitude.
4. Duration of sunshine.

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CHAPTER III.—THERMOMETER.

Section I. Conversion.

1. R. to C.
2. F. ,, C.
3. C. ,, F.
4. F. ,, C. differences
5. C. ,, F. ,,

Section II. Reduction of Temperature to Sea-level.

1. Metric.
2. English.

CHAPTER IV.—BAROMETER.

1. Barometer to 0° C. Metric (0°·1 C. and 5 mm.).
2. ,, ,, 32° F. (0°·5 F. and 0·2 ins.).
3. Gravity ... Latitude ... metric.
4. ,, ... ,, ... English.
5. ,, ... Altitude ... metric.
6. ,, ... ,, ... English.
7. Barometer to sea-level ... ... metric.
8. ,, ,, ... English.

CHAPTER V.—HYGROMETRY, RAIN, AND EVAPORATION.

1. Vapour-tension to 0·1 C. from − 30° C. to + 101° C.
2. ,, ,, 0·2 F. ,, − 20° F. ,, + 214° F.
3. Boiling-point (from 680 mm.—800 mm.) ... metric.
4. ,, ,, ,, ... English.
5. Vapour-tension about 100° C. ... ... metric.
6. ,, ,, 212° F. ... ... English.
7. Weight of water in cubic metre of air ... metric.
8. ,, ,, foot ,, ... English.
9. Relative humidity ... ... metric.
10. ,, ,, ... English.

CHAPTER VI.—WIND.

1. Lambert's formula.
2. Natural tangents.
3. Kilometres per hour to metres per second.
4. Metres per second ,, kilometres per hour.
5. Miles per hour ,, metres per second.
6. Metres per second ,, miles per hour.

CHAPTER VII.—MAGNETISM AND ELECTRICITY.

1. English mag. units to C.G.S. units.
2. C.G.S. ,, Eng. mag.

Weight and Mass.

THE review of Kennedy's "Mechanics of Machinery" in NATURE, December 29, 1887 (p. 195), strikes at least one responsive chord on this side of the world. There are some questions in reference to the nomenclature of dynamics which "will not down" until they are "downed" by a convention or agreement between those who have to do with the theory of mechanics and those who have to do mostly with practice, and in this some concessions will doubtless be necessary on both sides. While in hearty sympathy with much that the reviewer says in his discussion of dynamical terms (the book under notice I have not yet seen), I wish to dissent from and to protest against one of his leading propositions.

It must be admitted that in the "vernacular" the word pound is used in two distinct senses—that is, as a unit of force and a unit of mass. Authors of mathematical treatises have sometimes, and perhaps unconsciously, ignored the latter meaning, and at other times have failed to recognize the former.

The proposition of the reviewer is to eliminate the word *mass* altogether and to use weight in its stead. To accomplish this he is obliged to use the word *weight* as meaning what is now generally expressed by the word *mass*. This, it seems to me, would be a grave error. Is it not true that *weight*, as understood by both the "learned and the unlearned" always carries with it the idea of force, the force of attraction between the earth and the particular body under consideration? And is it not also true that there are many problems in the work of the practical engineer in which *mass*, in the ordinarily accepted sense, is the essential element, rather than weight, in the ordinarily accepted sense? In short, in my judgment, the engineer *does* require the word "mass," and he also needs the word "weight." It is a misfortune when one word must be used to mean two entirely different things (as is the case of the word "pound"), and we ought to congratulate ourselves that we have the words "mass" and "weight" so commonly and generally used to represent two distinct ideas. To discard one of them and force the other into its place would be to introduce confusion rather than order. To satisfy the requirements of both mathematical or theoretical and practical convenience I have been accustomed to use the following:—

The word *pound* is used in two senses; it may mean a unit of mass or a unit of force. It is always easy by the context to tell in which sense it is used.

As a unit of force it *has not yet been accurately defined*, but it means, in general a force equal to the attraction between the earth and a mass of one pound. As this attraction varies slightly, the pound as a unit force cannot be regarded as absolutely constant, but is sufficiently so for practical purposes.

When, by a convention of authorities, the conditions under which this attraction is accepted as equal to one pound are prescribed, it will become an invariable unit.

There are in the English system two units of force, the poundal and the pound. There are also two units of work, the foot-poundal and the foot-pound; each is the work done by the corresponding unit of force working through a distance of one foot.

The ordinary equations of dynamics, when the foot-pound-second units are used, give results in poundals or foot-poundals, which may at once be reduced to pounds or foot-pounds.

The above is open to the objection that the pound as a unit of force is not constant, but the remedy for this is indicated, and the errors introduced are of no moment in "practice."

To lessen the confusion somewhat, I have often used, in writing, the symbol *lb.* to represent the unit of *mass*, and the word *pound* that of force. In my own experience the adoption of these definitions has greatly facilitated the work of students.

I entirely agree with the criticisms made upon the equation so constantly appearing, $w = mg$. To the learner it is generally "confusion confounded," and I would cheerfully join in a "boycott" against it.

T. C. MENDENHALL.

Rose Polytechnic Institute, Terre Haute, Indiana,
U.S.A., January 26.

ONCE more Prof. Greenhill devotes a large portion of a review to emphasizing and insisting on his peculiar, and I may say extraordinary, mode of regarding the meaning of elementary terms (see NATURE, February 16, p. 361; also December 29, 1887, p. 195).

One must assume, therefore, that these views are regarded by him as useful and conducive to clearness.

I find it difficult to express strongly enough my entire dissent from such a proposition without being apparently impolite.

That engineers are entitled if they see fit to employ as their third fundamental standard a standard of force rather than one of mass, I admit. I do not think the plan satisfactory or clear, but there are temptations towards it, and perhaps no very serious objections. My own experience of engineering students is, however, that they are beautifully uncertain whether to put g into the numerator or the denominator of a new expression, or whether to leave it out altogether; and that they generally get over the difficulty either by asking where it must go, or by seeing which plan will give an answer of most reasonable magnitude. The real rule on engineers' principles would be to put g somewhere into the expression for any quantity with which gravity has nothing to do, and to leave g out whenever gravity is primarily concerned.

But, irrespective of this standing and well-known controversy, Prof. Greenhill's attempt to simplify matters does indeed make confusion worse confounded. He says that in the vernacular the term "weight" does not mean the force with which the earth pulls a body, but does mean the body's mass or inertia.

What kind of "vernacular" can he be thinking of?

Ask any ordinary member of the British public what he or she means by the "weight" of a thing, and you will get answers such as "its heaviness," or "its heft," or the "force required to lift it," or "the difficulty of raising it," or "the pull up you must give it," or any number of such replies; but if he ever got the answer, "I mean the mass of the body, in other words its inertia, a measure of the quantity of matter the body contains," surely he would not be satisfied with this as a fair specimen of the vernacular, but would rather regard it as one of those answers so frequently given to examiners—the product of a mind so tortured by instructors that its common-sense and vernacular are completely atrophied.

OLIVER J. LODGE.

The Composition of Water

Two days after the publication of my letter in NATURE (p. 390), on the composition of water, I received the Manchester

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